

Listing of Claims

The below listing of claims will replace all prior versions of claims in the application.

1. (Cancelled)
2. (Currently Amended) The method of claim + 35, wherein the etchant comprises a mixture of nitric acid, hydrofluoric acid, and acetic acid.
3. (Currently Amended) The method of claim + 35, wherein the etchant flows through the channel across the exposed surface at a rate of at least 0.7 meters/second.
4. (Currently Amended) The method of claim + 35, wherein the flow of the etchant through the channel across the exposed surface is turbulent.
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5. (Currently Amended) The method of claim + 35, wherein the flowing of the etchant is performed in a sealed chamber formed by the support member and the adapter member.
6. (Currently Amended) The method of claim + 35, further comprising flowing an acidic solution through the channel across the exposed surface from the first edge of the exposed surface to the second edge of the exposed surface to at least partially remove oxide on the exposed surface.
7. (Currently Amended) The method of claim + 35, further comprising flowing an acidic solution through the channel across the exposed surface from the first edge of the exposed surface to the second edge of the exposed surface to at least partially remove oxide on the exposed surface, wherein the acidic solution comprises hydrofluoric acid, the flowing of the acidic solution preceding the flowing of the etchant.
8. (Currently Amended) The method of claim + 35, further comprising flowing an acidic solution through the channel across the exposed surface from the first edge of the

exposed surface to the second edge of the exposed surface, wherein the flowing of the acidic solution is subsequent to the flowing of the etchant.

9. (Currently Amended) The method of claim 4 35, further comprising flowing an acidic solution through the channel across the exposed surface from the first edge of the exposed surface to the second edge of the exposed surface, wherein the flowing of the acidic solution is subsequent to the flowing of the etchant, wherein the acidic solution comprises hydrofluoric acid and nitric acid.

10. (Currently Amended) The method of claim 4 35, wherein the flowing of the etchant further comprises flowing a layer of etchant through the channel across the exposed surface from a the first edge of the exposed surface to a the second edge of exposed surface to [thin] etch the semiconductor die, the layer having a thickness less than about 0.5 millimeters.

11. (Currently Amended) The method of claim 2, further comprising mixing the nitric acid, hydrofluoric acid, and acetic acid in a spherical mixing chamber before flowing the etchant through the channel across the ~~die~~ second exposed surface of the semiconductor die.

12. (Currently Amended) The method of claim 4 35, wherein the semiconductor die further comprises an unexposed surface at least partially disposed within an encapsulant, the exposed surface being exposed through a cavity formed in the encapsulant.

13. (Cancelled)

14. (Currently Amended) The method of claim 4 36, wherein the etchant comprises a mixture of nitric acid, hydrofluoric acid, and acetic acid.

15. (Currently Amended) The method of claim 4 36, wherein the etchant flows through the channel across the ~~die~~ second surface of the semiconductor die at a rate of at least 0.7 meters/second.

16. (Currently Amended) The method of claim 13 36, wherein the flow of the etchant through the channel across the die second surface of the semiconductor die is turbulent.

17. (Currently Amended) The method of claim 13 36, wherein the flowing of the etchant is performed in a sealed chamber formed by the support member and the adapter member.

18. (Currently Amended) The method of claim 13 36, wherein the first acidic solution further comprises hydrofluoric acid.

19. (Currently Amended) The method of claim 13 36, wherein the second acidic solution comprises hydrofluoric acid and nitric acid.

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20. (Currently Amended) The method of claim 13 36, wherein the flowing of the etchant further comprises flowing a layer of etchant through the channel across the die second surface of the semiconductor die from a the first edge of the second surface to a the second edge of the second surface to [thin] etch the semiconductor die.

21. (Currently Amended) The method of claim 13 36, wherein the first surface of the semiconductor die further comprises an unexposed surface disposed within an encapsulant, and the second surface of the semiconductor die comprises an the exposed surface being exposed through a cavity formed in the encapsulant.

22. (Reinstated and Currently Amended) An apparatus for etching a semiconductor die, the apparatus comprising:

a first member having a support surface for supporting [a] the semiconductor die, the semiconductor die having an exposed surface disposed between first and second edges thereof;

a second member having a first surface disposed adjacent the support surface such that when a semiconductor die is disposed on the support surface with the exposed surface adjacent the first surface of the second member, a channel is formed between the first surface of the second member and the exposed surface of the semiconductor die; and

an input conduit in fluid communication with the channel for providing a supply of etchant to the channel for [flow] flowing across the exposed surface of the semiconductor die from the first edge to the second edge.

23. (Reinstated) The apparatus of claim 22, wherein the input conduit is formed in the second member.

24. (Reinstated) The apparatus of claim 22, wherein the input conduit further comprises a spherical mixing chamber.

25. (Reinstated) The apparatus of claim 22, further comprising a movable post, the first member being mounted on the post for moving the first member relative to the second member.

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26. (Reinstated) The apparatus of claim 22, further comprising an output conduit in fluid communication with the channel, wherein the input conduit is positioned adjacent the first edge of the exposed surface and the output conduct is positioned adjacent the second edge of the exposed surface to permit the etchant to pass from the input conduit across the exposed surface to the output conduit.

27. (Reinstated) The apparatus of claim 22, wherein the input conduit further comprises a spherical mixing chamber having a supply conduit in fluid communication with the spherical mixing chamber, the supply conduit oriented tangentially to the spherical mixing chamber.

28. (Reinstated) The apparatus of claim 22, further comprising an agitator coupled to the input conduit.

29. (Currently Amended) A method for thinning a semiconductor die at least partially disposed in a semiconductor package, the method comprising:

providing a semiconductor die having opposing active and inactive surfaces, the semiconductor die being disposed in a semiconductor package with the inactive surface being at least partially exposed through a cavity formed in the semiconductor package;

inserting a first surface of a first member into the cavity to form a channel between the first surface of the first member and the inactive surface of the semiconductor die; and
flowing an etchant through the channel to etch the inactive surface of the semiconductor die.

30. (Currently Amended) The method of claim 29, wherein the flowing of the etchant is performed in a sealed chamber.

31. (Original) The method of claim 29, wherein the etchant flows across the inactive surface of the semiconductor die at a rate of at least 0.7 meters/second.

32. (Original) The method of claim 29, wherein the etchant flows across the inactive surface of the semiconductor die in a turbulent manner.

33. (Currently Amended) The method of claim 29, further comprising flowing an oxide removing liquid across the inactive surface of the semiconductor die to remove at least a portion of any oxides disposed on the inactive surface, wherein the flowing of the oxide removing liquid precedes the flowing of the etchant.

34. (Reinstated and Currently Amended) An apparatus for etching a semiconductor die having opposing first and second surfaces, the apparatus comprising:

[a semiconductor die having opposing first and second surfaces;]
means for flowing an etchant across the [die] second surface of the semiconductor die from a first edge of the second surface to a second edge of second surface to [thin] etch the semiconductor die, the means comprising a first member being positioned above the semiconductor die for forming a channel between the first member and the semiconductor die such that the etchant flows in the channel to etch the semiconductor die.

35. (New) A method for etching a semiconductor die having an exposed surface disposed between first and second edges, the method comprising:

providing an etching assembly including a support member and an adapter member;
positioning the semiconductor die on the support member, the exposed surface of the semiconductor die facing away from the support member;

positioning the adapter member adjacent the exposed surface of the semiconductor die to form a channel between the exposed surface of the semiconductor die and the adapter member; and

flowing an etchant through the channel across the exposed surface from the first edge to the second edge to etch the semiconductor die.

36. (New) A method for etching a semiconductor die having opposing first and second surfaces, the method comprising:

providing an etching assembly including a support member and an adapter member;

positioning the semiconductor die on the support member, the second surface of the semiconductor die facing away from the support member;

positioning the adapter member adjacent the second surface of the semiconductor die to form a channel between the second surface of the semiconductor die and the adapter member;

flowing a first acidic solution through the channel across the second surface of the semiconductor die to at least partially remove oxide on the second surface;

flowing an etchant through the channel across the second surface from a first edge of the second surface to a second edge of the second surface to etch the semiconductor die; and

flowing a second acidic solution through the channel across the second surface of the semiconductor die to at least partially polish the second surface of the semiconductor die.

37. (New) An apparatus for etching a semiconductor die, the apparatus comprising:

a holder member having a support surface for supporting the semiconductor die, the semiconductor die having an exposed surface disposed between first and second edges thereof;

an adaptor member having a first surface disposed adjacent the support surface such that when a semiconductor die is disposed on the support surface with the exposed surface adjacent the first surface of the adaptor member, a channel is formed between the first surface of the adaptor member and the exposed surface of the semiconductor die; and

an input conduit in fluid communication with the channel for providing a supply of etchant to the channel for flowing across the exposed surface of the semiconductor die from the first edge to the second edge.